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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,059	12/30/2003	Hiroshi Miyazaki	TI-36833	9129
23494	7590	04/24/2006	EXAMINER	
TEXAS INSTRUMENTS INCORPORATED P O BOX 655474, M/S 3999 DALLAS, TX 75265			LE, THAO X	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 04/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No. 10/750,059	Applicant(s) MIYAZAKI, HIROSHI	
	Examiner Thao X. Le	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6,8-11 and 28-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,8-11 and 28-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 31 Mar. 2006 has been entered.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 4, 6, 8-11, 28-29 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6770547 to Inoue et al.

Regarding claim 1, Inoue discloses an interconnect structure in fig. 30 comprising: a substrate 13, col. 5 line 58 (device includes a semiconductor substrate); a conductive contact pad 4, col. 7 line 4, having a first elastic modulus disposed over a

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portion of the substrate surface 13, having an inner portion 4 and an outer portion 4/7 (layer 4 in contact pad 7 in fig. 21), the outer portion 4/7 of the conductive contact pad completely surrounding the inner portion 4 of the conductive pad; a compliant layer 5, col. 7 line 7, having a second elastic modulus lower than the first elastic modulus (metal modulus of metal 4/7 vs. polymer modulus of resin 5), disposed directly under the inner portion 4 of the contact pad but not under the outer portion of the contact pad 4/7, fig. 21, the inner portion of the contact pad 4 over the compliant layer 5 having a thickness thinner than the thickness of the outer portion 4/7 of the contact pad; and an insulative mask 6, col. 8 line 10, disposed over the contact pad, including an opening (where solder ball 1 is located), fig. 30, that exposes the inner portion of the contact pad, fig. 30.

Regarding claim 4, Inoue discloses the interconnect structure in which the contact pad 4 comprises copper, column 7 line 50, and the compliant layer 5 comprises a material having an elastic modulus lower than the elastic modulus of copper, see discussion in claim 1.

Regarding claims 8-10, Inoue discloses the interconnect structure in which the inner portion of the contact pad 4 is more flexible than the outer portion. Inherently, the thicker portion 4/7 would be more rigid than the thinner portion 4, wherein the opening uncovers a substantially planar contact surface, fig. 20-21, wherein the structure further including a solder contact 1, col. 8 line 35, attached to the contact surface, fig. 30, the solder contact 1 including a contact portion defined by the opening of the insulative mask 6, fig. 30.

Regarding claim 11, Inoue discloses the interconnect structure wherein the thickness of the compliant layer 5 (35-150 micrometer) is greater than the thickness of the outer portion 4/7 of the contact pad, fig. 30.

Regarding claims 28-29, Inoue discloses the interconnect structure wherein the contact pad 4 comprises a conductive metal 4/7, col. 5 line 61 and col. 7 line 50, and the compliant material 5 comprises a polymer, col. 7 lines 7, wherein the compliant layer 5 comprises a dielectric material 6, fig. 30.

4. Claims 30 and 33 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6552563 to Yaniv et al.

Regarding claim 30, Yaniv discloses a semiconductor device in fig. 8 comprising: a substrate 100; a conductive contact pad 626/620 having a first elastic modulus, disposed over the substrate 100, having an inner portion 626 and an outer portion 626/620, the inner portion 626 having a first thickness, the outer portion 626/620 having a second thickness greater than the thickness and enclosing the inner portion 626; a compliant layer 624 having a second elastic modulus lower than the first elastic modulus, disposed directly under the contact pad 626, covered by the inner portion 626 of the contact pad and contacting the outer portion 626/620 of the contact pad.

Regarding claim 33, Yaniv discloses the semiconductor device in which the compliant layer 624 has a thickness greater than the second thickness, fig. 8.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over US 6770547 to Inoue et al. in view of US 5187020 to Kwon et al.

Regarding claim 3, Inoue discloses the interconnect structure wherein the contact pad comprises a conductive metal 4/7.

But Inoue does not disclose the interconnect structure wherein the compliant layer comprises a metal

However, Kwon discloses a interconnect structure wherein the compliant layer 15 comprises a metal (conductive), col. 3 lines 10-11. At the time the invention was made; it would have been obvious to one of ordinary skill in the art to use the compliant layer teaching of Kwon with Inoue's device, because it would have created a contact adequately compressed to assure a good, solid electrical contact and without permanent deformation of the compliant material as taught by Kwon in col. 3 lines 22-28.

7. Claims 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5508228 to Nolan et al. in view of US 6919264 to Brintzinger.

Regarding claim 30, Nolan discloses a semiconductor device in fig. 3 comprising: a substrate 12; a conductive contact pad 26 having a first elastic modulus, disposed

over the substrate 12, having an inner portion (top layer) and an outer portion (bottom and side wall), the inner portion having a first thickness, the outer portion having a second thickness, and enclosing the inner portion; a compliant layer 24, col. 5 line 38, having a second elastic modulus lower than the first elastic modulus, disposed directly under the contact pad, covered by the inner portion of the contact pad and contacting the outer portion of the contact pad.

But Nolan does not expressly disclose the thickness of the outer portion is greater than the thickness of the inner portion.

However, Nolan discloses the inner portion 26 is approximately as shown in fig. 8 thinner than the outer portion and that the thickness of layer 26 can be adjusted to create an effective modulus of the pad, col. 6 line 23-27.

Accordingly, it would have been obvious to one of ordinary skill in the art to use the teaching of Nolan in the range as claimed, because it has been held that where the general conditions of the claims are disclosed in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

Regarding claim 31, Nolan discloses the semiconductor device in which the inner portion and the outer portion of the contact are approximately co-planar.

However, Brintzinger discloses the semiconductor device in fig. 6 wherein the inner portion (layer 4-7 in contact with compliant layer 2) and the outer portion (layer 4-7 in contact the side wall of layer 2) of the contact are co-planar. At the time the invention was made; it would have been obvious to one of

ordinary skill in the art to use the teaching of Brintzinger with Nolan's device, because such configuration have provided a better surface contact. In re Dailey 149 USPQ 47, 50 (CCPA 1966). See also Glue Co. v. Upton 97 US 3,24 (USSC 1878).

Regarding claims 32 and 33, Nolan discloses the semiconductor device in which the outer portion has a first bottom surface, the compliant layer 24 has a second bottom surface, and the first and the second bottom surfaces are co-planar, and the compliant layer has a thickness greater than the second thickness, fig. 3.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X. Le whose telephone number is (571) 272-1708. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M. Fahmy can be reached on (571) 272 -1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic
Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

Thao X. Le
18 April 2006